DRAFT FINAL

TAILINGS AREAS AND EVAPORATION PONDS WORK PLAN

FEBRUARY 14, 2003

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February 14, 2003

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Subject: Response to Comments on the Draft Tailings Areas and Evaporation Ponds Work Plan dated August 26, 2002 and submittal of the Draft Final Tailings Areas and Evaporation Ponds Work Plan for the Yerington Mine

Atlantic Richfield Company appreciates this opportunity to respond to the comments provided by the regulatory agencies on October 24, 2002 for the subject document. This response to comments letter is attached to the Draft Final Tailings Areas and Evaporation Ponds Work Plan.

NDEP Comments

NDEP General Comments

The proposed sample quantities and locations are inadequate to defensibly characterize the various tailings areas. Sampling should not only characterize these materials for all potential constituents of concern and establish background concentrations of naturally occurring metals in soils, but also vertically delineate the characterized material. The limited sampling proposed will not provide adequate information to allow future decisions regarding vertical migration of fluids. It is inadequate to evaluate potential hazards to human health and the environment, does not establish background concentrations of metals for comparison of analytical results, will not provide adequate information to avoid conflict and thus is not in the best interest of all parties concerned. Please propose a statistically defensible sampling plan of all tailings areas and background soil locations that will satisfy the requirements listed above.

The attached Draft Final Tailings Areas and Evaporation Ponds Work Plan has been revised to address this comment. The number of sample locations has been increased in *the Tailings Areas and Ponds. Monitoring wells and soil-moisture monitoring locations have been added to the Tailings Areas, as part of the companion Draft Groundwater Conditions Work Plan. References to details on particular photos or maps in Appendix C have been included.*

<u>NDEP Specific Comments</u>

<u>Page 1; Introduction</u>
The Municipal Sewage Treatment Lagoons as discussed in this paragraph have not been labeled on any of the figures in the report. Because these lagoons are to be investigated as part of this work plan, the figures should be revised to include location labels for the lagoons.

The attached Draft Final Tailings Areas and Evaporation Ponds Work Plan has been revised to address this comment.

<u>Page 2; Lined Evaporation Ponds</u>
This section is confusing. Currently there are three active ponds for the pumpback system not one. Two have an HDPE liner and one is clay lined.

The attached Draft Final Tailings Areas and Evaporation Ponds Work Plan has been revised to address this comment.

<u>Landfills and Abandoned Features</u>
There are two or more solid waste landfills not one or more. To the northeast is the Arimetco landfill and to the northwest is the Weed Heights/Don Tibbals landfill.

The attached Draft Final Tailings Areas and Evaporation Ponds Work Plan has been revised to address this comment.

<u>Trans-mine Asbestos Pipe</u>
I think the proper term here is Transite Asbestos pipe.

The attached Draft Final Tailings Areas and Evaporation Ponds Work Plan has been revised to address this comment, and uses the term Transite Pipe.

Page 8; Last sentence has a typo. This conveyor delivered the <u>crushed?</u> to haul trucks for….Should be leached ore or tailings?

The attached Draft Final Tailings Areas and Evaporation Ponds Work Plan has been revised to address this comment.

Page 9; Oxide Tailings (VLT) Area

VLT has been used in asphalt, concrete and as engineered fill, both on and off the mine property. It was hauled off site for private and county use up until the mid 1990's. VLT was also used to construct the dams around the sulfide tailings impoundments and for dust control capping.

The attached Draft Final Tailings Areas and Evaporation Ponds Work Plan has been revised to address this comment.

Page 12; First paragraph

The red dust referred to was present prior to Arimetco's excavation. This site included approximately 13 acres of exposed red dusty tailings. Arimetco's excavation was in the southeast corner. The entire area was capped with VLT by the NDEP as a temporary measure to control dust.

The attached Draft Final Tailings Areas and Evaporation Ponds Work Plan has been revised to address this comment. However, it is Atlantic Richfield's position that Arimetco's excavation of this area and subsequent failure to responsibly control dust caused the vast majority of dust emissions from this area, as substantiated by aerial photos of this area.

2.5; Lined Evaporation Ponds

Please clarify how Appendix C is to be used to determine years of operation and what particular sections of Appendix C are relevant to this discussion.

The attached Draft Final Tailings Areas and Evaporation Ponds Work Plan has been revised to incorporate this comment.

Page 13; Weed Heights Sewage Lagoon

Anaconda sewage had previously gone to the finger ponds. The existing sewage treatment lagoons were constructed by Weed Heights/Don Tibbals in 1985. Arimetco had no involvement with the construction or maintenance of the sewage lagoons. Also, sewage lagoons are not labeled in figure 4.

The attached Draft Final Tailings Areas and Evaporation Ponds Work Plan has been revised to include labeling of the sewage lagoons.

Photo in Appendix D not E also photo 7 not photo 8.

The attached Draft Final Tailings Areas and Evaporation Ponds Work Plan has been revised to address this comment.

<u>Page 17; 2.10 Summary of Current Conditions</u>
Add The Arimetco Landfill is still in use by the state contractors.

The attached Draft Final Tailings Areas and Evaporation Ponds Work Plan has been revised to address this comment.

<u>Page 20; Sulfide Tailings Area</u>
Sample depth may be to shallow. The VLT cover in some areas is over five feet deep.

The attached Draft Final Tailings Areas and Evaporation Ponds Work Plan has been revised to provide for sampling through the thickness of the VLT cover, as appropriate (e.g., sample locations may be moved to allow for sample collection of sulfide tailings that are not covered).

<u>Finger Evaporation Ponds</u>
May need to sample a little deeper to get to original red material. The dust capping of VLT is up to 12 inches and may be deeper in certain areas.

Please see response to the previous comment.

<u>Figure 4</u>
Add to key that brown line is buried sewer line.

The attached Draft Final Tailings Areas and Evaporation Ponds Work Plan has been revised to address this comment.

<u>Figure 6</u>
This figure is missing from the report; hence no references to figure 6 could be reviewed and evaluated.

The attached Draft Final Tailings Areas and Evaporation Ponds Work Plan has been revised to include Figure 6.

Also the text calls for one sample in each of the pumpback ponds. Two of the ponds have an HDPE liner. If the samples are under the liner, how will it be dealt with?

The Lined Evaporation Ponds in Section 3.1 were erroneously referred to as the Pumpback Ponds, which has been corrected in the attached Draft Final Tailings Areas and Evaporation Ponds Work Plan. Sampling below the liner of the Lined Evaporation Ponds is not proposed. Samples of solid materials above the liner of the Lined Evaporation Ponds will be collected and analyzed.

EPA Comments

<u>EPA General Comments</u>

1) The discussion regarding exposure scenarios is incomplete. In order to provide a conservative estimate of risk for comparison, the residential exposure pathway is required to be assessed for each area. This also would give an assessment of the risk any trespassers would encounter although every effort is underway to ensure that the Site is inaccessible. After the data is collected, it should be compared to screening values, such as EPA Region IX Preliminary Remediation Goals. At this time, the determination can be made as to the necessity of a risk assessment for a given area. There is also no discussion of possible exposure pathways for ecological receptors. Regulatory agency staff have observed wildlife in these areas and potential pathways should be considered in planning the investigation.

Atlantic Richfield agrees that the collected data should be compared to the appropriate screening values, which will be presented in the Data Summary Report for the Tailings Areas and Evaporation Ponds. Such comparisons serve as a tool for decision-making to support site closure, which will be evaluated in the development of the Final Permanent Closure Plan (FPCP). Potential exposure pathways and receptors associated with the Tailings Areas and Evaporation Ponds are presented in Figure 3 of the attached Draft Final Tailings Areas and Evaporation Ponds Work Plan. A discussion of potential pathways and receptors relevant to the Tailings Areas and Evaporation Ponds was presented in the Site Conceptual Model dated August 26, 2002.

2) Page 3, Table 1; The background values cited in this report may represent background soil levels, however, it is premature to cite them definitively as background at this time. EPA has also collected a possible background sample, BK-1, with the results included in EPA's "Anaconda, Yerington Mine Site Emergency Response, Assessment Final Report," dated June 30, 2001. EPA can provide this report if needed. Appropriate background levels should be discussed in our Technical Workgroup meetings.

In lieu of other data suggesting values other than those by Shacklette and Boerngen (1984), Atlantic Richfield believes that these data represent background soil metals concentrations at the mine site. Given that sample BK-1 is categorized as a "possible" background sample in this comment, Atlantic Richfield does not believe it appropriate to include this analysis in the attached Draft Final Tailings Areas and Evaporation Ponds Work Plan. Additional information on background soil geochemical characteristics will be obtained through implementation of the Cover Materials Work Plan.

3) As mentioned in prior meetings, any known spill history for the tailings areas should be included. At a minimum, Atlantic Richfield should review NDEP's records of spills and attempt to interview past employees to determine their potential knowledge of spills. In Sections 2.4 and 2.5 only Dalton, a former contractor for Arimetco, is cited as a source for information related to Anaconda's history.

The attached Draft Final Tailings Areas and Evaporation Ponds Work Plan has been revised to describe a review of NDEP files for spills in these areas. As indicated in previous responses to comments, Atlantic Richfield has attempted to eliminate, to the extent practicable, undocumented anecdotal information (i.e., past employee interviews) from providing the basis for field investigations proposed under the Scope of Work. However, to be as complete as possible in the assessment of past and current site conditions, Atlantic Richfield has utilized information gleaned from old Yerington Mine Site records kept at the mine site office building. In addition, at the request of NDEP, Atlantic Richfield has also incorporated anecdotal and documented information provided by Mr. Joe Sawyer of SRK Consulting.

4) The Quality Assurance and Quality Control sections are incomplete and it is our understanding that Atlantic Richfield will be submitting a comprehensive site-wide Quality Assurance Project Plan (QAPP) in accordance with EPA's guidance documents (EPA will provide these on request or they can be obtained from EPA's website). After review of the QAPP, the agencies will further comment on any supplementary Quality Assurance/Quality Control sections in the specific work plans. Please provide a date for submittal of the QAPP as this must be reviewed and approved prior to initiation of fieldwork.

The Draft Quality Assurance Project Plan (QAPP) was submitted on December 6, 2002. The attached Draft Final Tailings Areas and Evaporation Ponds Work Plan incorporates the information provided in the Qapp.

5) Radionuclide screening and/or analyses should be proposed. At a minimum, all samples should be screened for radionuclides and a percentage of samples should be analyzed in the laboratory.

Atlantic Richfield is currently evaluating site and background information on radionuclides, and anticipates that the final version of the Tailings Areas and Evaporation Ponds Work Plan will provide information that satisfies this comment.

<u>EPA Specific Comments</u>

1) Page 4; Did NDEP conduct MWMP Leaching Tests or SPLP (synthetic precipitation leach procedures, SW 846 MTD 1312) (Table 2)? Either test is fine, just want to be sure the workplan is accurate.

The attached Draft Final Tailings Areas and Evaporation Ponds Work Plan has been revised to reflect that the SPLP was performed.

2) Page 5; The "remolded" permeability test results for the sulfide tailings of a $2X10^{7}$cm/sec should not be confused with the current in place permeability of these tailings, which is not known. Since the permeability of these tailings may be low, it should be determined in place (recommend double ring infiltrometer test).

The attached Draft Final Tailings Areas and Evaporation Ponds Work Plan has been revised to note that the permeability value was derived from ex-situ testing. The intent of the testing was to determine the applicability of sulfide tailings for use as a capping material, and ex-situ testing is an appropriate method for that application. Atlantic Richfield does not believe in-situ permeability testing for the sulfide tailings is necessary, given the proposed installation of soil moisture monitoring probes, as described in the companion Draft Groundwater Conditions Work Plan.

3) Page 5; DQOs; An important DQO not mentioned is to determine whether the tailings and evaporation ponds serve as a continuing source of contaminants leached to groundwater. Also, the first DQO should include the other mine units also.

The proposed installation of soil moisture monitoring probes in the sulfide tailings, as described in the companion Draft Groundwater Conditions Work Plan, will provide adequate data to evaluate the potential for this surface mine unit to source COCs to groundwater.

4) Page 9; Is any data available on runoff or pond water from the VLT? If not, it is appropriate to collect this information. This could provide insight on the leachability of these tailings.

Atlantic Richfield is not familiar with data of this type. If EPA is in possession of such data, please forward it to Atlantic Richfield for evaluation and possible inclusion in the final version of the Tailings Areas and Evaporation Ponds Work Plan. However, collection of run-off or pond water quality data is not necessary because the Groundwater Conditions Work Plan will evaluate the potential of COCs to groundwater.

5) Page 14; Transite pipeline. What was transported in this pipeline? Could this pipeline have served as a source area for contaminants leached to groundwater via leaks?

The pipeline conveyed acidic solutions and sulfide tailings slurry. Although no documentation has been found to suggest leaks or releases along the pipeline, this pipeline may have leaked potential COCs. Therefore, field screening for pH and sample collection have been added to the attached Draft Final Tailings Areas and Evaporation Ponds Work Plan for locations along and below the pipeline where breaches in the pipe or apparent soil staining are observed. The pipeline alignment will be confirmed as part of this Work Plan.

6) Page 15, photo C1; It is noted that the 'unlined evaporation pond" appears to cover a much larger area in this photo than is shown on figure 2. This may be significant in locating the original source area for the groundwater contamination, thus borings at depth in this area including leach testing may be warranted.

The 1954 photo and 1957 map indicate a "Tailings Pond" area (not Unlined Evaporation Pond) that covers roughly the current Unlined Evaporation Pond, Sulfide Tailings Area, and the northern tip of the Process Solution Recycling Pond. Sampling has been proposed in the attached Draft Final Tailings Areas and Evaporation Ponds Work Plan in each of these areas. Boreholes are proposed for the Sulfide Tailings area for installation of monitoring wells and for subsurface moisture monitoring, and surface samples are proposed for the Unlined Evaporation Pond and Process Solution Recycling Pond. Leach testing is not proposed given the proposed moisture monitoring briefly described in the attached Draft Final Work Plan, and in more detail in the Draft Groundwater Conditions Work Plan.

7) Page 15, 1957 photo; It appears that the oxide tailings area has increased in size, not remained similar in size. The presence of unlined and lined evaporation ponds in the previous sulfide tailings disposal area could add water and mobility to move

contaminants into the groundwater causing the present plume of contaminated groundwater.

There is no 1957 photo, but there is a 1957 topographic map presented in Appendix C. The Oxide Tailings Area in the 1954 photo measures roughly 3,100 feet by 1,600 feet. The Oxide Tailings Area in the 1957 image measures the same dimensions. In regard to the presence of unlined and lined evaporation ponds in the previous sulfide tailings area, please refer to response to comment #6 above.

8) Page 16, 1977 photo; Is there any evidence to suggest that the fluid collection ditches were lined? It is appropriate to collect soil and groundwater samples along these ditch alignments to look for COCs. If these investigations are not proposed for this workplan, which report will include investigations for these presumed unlined ditches?

It is uncertain whether the former containment ditches were lined or unlined. The ditches have been filled in and graded, and their exact location is uncertain. Therefore, no site investigations are proposed along these former alignments. Assessment of the potential for these former alignments to sources COCs will not be necessary because the materials conveyed in these ditches are the same materials proposed to be sampled from tailings areas and evaporation ponds, as described in the attached Draft Final Work Plan.

9) Page 18, Section 3.0; It is premature to draw conclusions regarding the homogeneity of materials in all areas and limiting the amount of sampling proposed based on this hypothesis. Sufficient sampling should be proposed to confirm this hypothesis. Uniformity must also be established with depth. Also, determining whether waste materials continue to serve as a source of contaminants to groundwater should be included as an objective.

Additional monitoring wells and soil-moisture stations have been proposed for the Sulfide and Oxide Tailings Areas. Collected materials from these boreholes will be logged, together with information from previous EPA borings. This should provide adequate characterization of the subsurface materials in those areas. Soil moisture monitoring proposed in the Draft Groundwater Conditions Work Plan will serve to evaluate the potential for these materials to source COCs to groundwater.

10) Page 19; For the “lined ponds”, where the type and thickness of the liner is not known, a sample should be obtained by borings and the hole then grouted shut. It is useful to know how these ponds were lined as it impacts both present and past possibilities for water carrying contaminants to groundwater.

Subsurface samples of pond materials will be collected and analyzed without penetrating liners for closure characterization. If any penetration of a liner occurs, it will be repaired. Documentation of how the ponds were lined has not been found.

11) Page 20, Section 3.1; As stated in the report, many of the evaporation ponds and tailings are unlined. Better estimates of depth are needed to both determine whether there is a continuing source to groundwater and to select an appropriate closure and/or cleanup alternative.

Please see responses to previous comments (e.g., NDEP General Comments and EPA specific comment nos. 2, 3, 4, 8 and 9).

12) Page 22; How will the potential for the materials to generate fugitive dust be evaluated?

Grain size and geochemical analyses of surface materials sampled as under the attached Draft Final Tailings Areas and Evaporation Ponds Work Plan, will assist in this evaluation. This information will be integrated with the results of the Fugitive Dust Work Plan to assist in the evaluation of site closure alternatives in the context of possible fugitive dust emissions.

13) Figure 2; The Trans-mine pipe route does not appear to be plotted on this figure.

The transite pipe route is described in the attached Draft Final Tailings Areas and Evaporation Ponds Work Plan. As part of this Work Plan, the transite pipe alignment will be confirmed and presented in the Data Summary Report for the Tailings Areas and Evaporation Ponds.

14) Table 1; The arsenic concentration for the finger evaporation pond sample is much higher than other samples. A secondary DQO should be to verify or discount, this value.

The reason for the relatively high arsenic value is uncertain. Analytical results from proposed sampling at the Finger Evaporation Ponds will be compared to the existing value in the Data Summary Report for the Tailings Areas and Evaporation Ponds. A secondary DQO for this specific evaluation is not required because the DQOs presented in the attached Draft Final Tailings Areas and Evaporation Ponds Work Plan are intended to be comprehensive in nature, and are not intended to address specific data sets.

15) Table 2 - Of most interest perhaps, are the Beryllium Leaching results for the VLT material. It is assumed, not stated, that units are in mg/l. These materials should be collected and leached to confirm or disprove these beryllium results.

The attached Draft Final Tailings Areas and Evaporation Ponds Work Plan has been revised to reflect the units in mg/L, as shown on the analytical reports. Leaching of samples collected under this Work Plan is not required, given the proposed moisture monitoring briefly described in this Work Plan and in more detail in the Draft Groundwater Conditions Work Plan.

16) Table 3; Please check your table for proposed metals and methods of analyses. At a minimum, antimony, silver and thallium should also be included.

The attached Draft Final Tailings Areas and Evaporation Ponds Work Plan has been revised to address this comment.

17) Appendix; NDEP Leach test results; A reference to the leaching and analytical methods should be included. No data are included for leaching of the Iron Bleed Tailings. Based on Comment # 15, such data should be obtained.

The attached Draft Final Tailings Areas and Evaporation Ponds Work Plan has been revised to describe these tests.

USDI/FWS Comments

<u>USDI/FWS General Comments</u>

Information is needed on the potential uptake of metals and trace elements by vegetation at these sites. Some vegetation may be deeply rooted and may eventually penetrate any cover caps that may be provided on these sites. Vegetation may be consumed by wildlife or cattle, exposing them to the metals and trace elements that are taken up by the plants. Burrowing mammals may experience dermal exposure to the materials (i.e., waste rock, leach heap, or evaporation pond) if they penetrate any caps on these sites. The risks from these types of exposure should be analyzed. Information is needed on the standards and toxicity benchmarks that will be used to evaluate any data that will be collected in relation to this work plan.

Based on the results of the proposed site investigations, the assessment of human health and ecological risk will be presented in the FPCP, including the appropriate standards and toxicity benchmarks.

<u>USDI/FWS Specific Comments</u>

<u>Section 1.4 Data Quality Objectives, Step 2</u>
An additional criterion should be added to the two that are already present, Specifically, will the collected data be adequate to evaluate the risks to various receptors? As the plan currently is written, we doubt that adequate data will be collected for this purpose. In step 3, down-gradient receptors are mentioned. However, wildlife, including migratory birds, are not mentioned and should be considered as receptors on these sites because they may drink solutions from the various ponds under various conditions.

Please see response to general comment above.

<u>Section 3.1 Mine Unit Investigations</u>
Material Geochemical and Geotechnical Characteristics, the number of samples to be collected for many of the areas seems inadequate based in the size of the areas, even though past data indicated homogeneity among samples. We recommend that the total number of samples to be collected be increased.

The attached Draft Final Tailings Areas and Evaporation Ponds Work Plan has been revised to address this comment. Specifically, the number of sample locations has been increased for the Tailings Areas and Recycling Ponds, including subsurface samples from proposed moisture monitoring locations described in the Draft Groundwater Conditions Work Plan.

<u>Section 3.2 Quality Assurance and Quality Control, Solids Materials Analysis</u>
Table 4 is cited but is missing.

The attached Draft Final Tailings Areas and Evaporation Ponds Work Plan has been revised to address this comment.

Wildlife, including migratory birds, have the potential to drink standing water at any of the evaporation pond sites, and therefore may be exposed to elevated concentrations of metals and trace elements. Therefore, water samples should be collected for metal and trace element analysis from all sites where standing water is present, even if this occurs for limited periods. Information on field parameters should also be collected at these sites, including at a minimum, pH, salinity, and conductivity. Sampling sites should include the pumpback evaporation ponds, with at least one sample from each pond, as the quality of water appears to vary in each pond based on visual observations. For other ponds, such as the lined and unlined evaporation ponds, water is present only seasonally. Therefore, at these sites at least one sample should be collected from each flooded section of each pond when water is present.

Collection of runoff or pond water quality data is not required because it is assumed that site closure and re-grading will preclude ponding of surface water and run-off.

If you have any questions regarding the revised document or the responses to comments, please contact me at 1-406-563-5211 ext. 430.

Sincerely,

Dave McCarthy
Project Manager

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SECTION 1.0
INTRODUCTION

Atlantic Richfield Company has prepared this Draft Final Tailings Areas and Evaporation Ponds Work Plan (Work Plan) to conduct investigations that will support an assessment of potential human health or ecological risk associated with these mine units and associated site components, and support planning for the permanent closure of these mine units and related components pursuant to the Closure Scope of Work (SOW) for the Yerington Mine Site. Because of the close spatial relationships between the Tailings Areas and the Evaporation Ponds, this Work Plan combines the site investigation activities anticipated in two Work Plans described in the SOW (Brown and Caldwell, 2002a). This Work Plan also proposes site investigation activities for related components that include two landfills, septic tanks and municipal sewage treatment lagoons, and associated piping. Results of the proposed site investigation activities described in this Work Plan will be compiled and presented in a Data Summary Report.

The remainder of Section 1.0 of this Work Plan describes the location and hydrologic setting of the Yerington Mine Site, the results of previous sites investigation activities, and the data quality objectives (DQOs) for this Work Plan. Section 2.0 presents information about the construction and operational history of these features, and a description of their current status. Section 3.0 presents the details of proposed site investigation activities including sampling locations, sampling protocols, proposed analyses and quality assurance and quality control (QA/QC) objectives pursuant to the Draft Quality Assurance Project Plan (QAPP; Brown and Caldwell, 2002b). Section 3.0 of this Work Plan also presents a task-specific Job Safety Analysis in the context of the comprehensive Health and Safety Plan for the Yerington Mine Site (Brown and Caldwell, 2002c). Section 4.0 lists references cited in this Work Plan.

1.1 Location

The Yerington Mine Site is located west and northwest of the town of Yerington in Lyon County, Nevada (Figure 1). The Tailings Areas and Evaporation Ponds, and associated features, consist of geographically and/or physically distinct units located within the northern portion of the mine site, as shown in Figure 2. Based on field inspections, review of record drawings and reports, and personal communications with Mr. Joe Sawyer of SRK Consulting, the mine units and related components addressed in this Work Plan (shown in Figures 2 through 5) include:

- Oxide Tailings Area is composed of vat leach tailings (VLT) materials, generally minus 3/8-inch in size, and is located between the Phase IV-VLT and Phase III-4X Arimetco Heap Leach Pads, and extends to the western margin of the mine site.
- Sulfide Tailings Area is located within the depositional areas for dewatered slurry from the sulfide ore beneficiation process. The Sulfide Tailings Area (including the Water Recycling Ponds) occupies the northeast corner of the mine site, and is the largest surface mine unit on the site.
- Water Recycling Ponds are located within the southern portion of the Sulfide Tailings Area. These ponds were used to clarify process water for re-use.
- Unlined Evaporation Ponds were used to evaporate process water. The largest is a triangular feature located between the Sulfide Tailings and the Phase IV-VLT Heap. Five "Finger Evaporation Ponds" are located beneath a portion, and north, of the Phase IV-VLT Heap.
- Lined Evaporation Ponds were also used to evaporate process water. Three historic ponds identified in this Work Plan are the south, middle, and north ponds. A fourth historic lined pond area is currently active, and is used to evaporate groundwater extracted from the pumpback well system.
- Pumpback Evaporation Ponds are used to evaporate groundwater from the pumpback system, and are located east of the Lined Evaporation Ponds and north of the Unlined Evaporation Ponds. Two of the pumpback evaporation ponds are lined with HDPE liners, and the third is clay-lined.
- Weed Heights Sewage Lagoons are active municipal features located in the southwestern corner of the South Lined Evaporation Pond, and consist of four adjacent settling/passive treatment sewage ponds. Sewage from Weed Heights and the Arimetco plant site reports to two septic tanks, and then to the lagoons.
- Landfills and Abandoned Features include two solid waste landfills within the mine site (Arimetco landfill and Old Weed Heights landfill) and other abandoned features (e.g., an apparent crusher support structure on the north side of the Oxide Tailings.
- Transite Pipe that traverses the mine site from the northeast corner of the W-3 Waste Rock Area to the southern end of the sulfide tailings area (alignment to be determined in this Work Plan). The approximate 12-inch diameter pipe is generally intact, and is connected with bell-and-spigot fittings.

1.2 Hydrogeologic Setting

The principal source of water in the Yerington area of Mason Valley is the Walker River (Huxel, 1969). The East and West Walker Rivers originate in the Sierra Nevada mountain range and merge south of the mine site, from whence the Walker River flows northward through the valley to Walker Gap. From Walker Gap, it turns eastward and then southeastward to Weber Reservoir and ultimately to its terminus at Walker Lake. The Walker River is the primary source of natural recharge to the alluvial groundwater flow system that underlies the mine site, given that recharge from precipitation is very low (the annual average precipitation rate is 5.46 inches per year).

The native ground beneath the features addressed in this Work Plan consists of unconsolidated alluvial deposits derived by erosion of the uplifted mountain block of the Singatse Range and alluvial materials deposited by the Walker River. These unconsolidated deposits, collectively called the valley-fill deposits by Huxel (1969), comprise four geologic units: younger alluvium (including the lacustrine deposits of Lake Lahontan), younger fan deposits, older alluvium and older fan deposits. Lake Lahontan lacustrine deposits appear to have been removed and reworked by the Walker River as it meandered back and forth across the valley (Huxel 1969). Huxel estimated that Pleistocene Lake Lahontan in Mason Valley persisted for a relatively short time and was less than 60 feet deep.

A detailed assessment of groundwater conditions associated with the Yerington Mine Site is the subject of the Draft Groundwater Conditions Work Plan, a companion document to this Draft Final Tailings and Evaporation Ponds Work Plan. The assessment of groundwater flow conditions and groundwater quality beneath some of the mine units, and down-gradient of all of the mine units, addressed in this Work Plan is discussed in the Draft Groundwater Conditions Work Plan (Brown and Caldwell, 2002d).

1.3 Previous Monitoring and Data Acquisition

The United States Environmental Protection Agency (U.S. EPA, 2000) analyzed one sample from each of the following mine units: Sulfide Tailings Area (sample T-10), an Unlined Evaporation Pond (sample T-7), a Finger Evaporation Pond (sample T-8), and a Lined Evaporation Pond (sample T-9). Whole-rock analyses were performed on these samples as part of an initial CERCLA evaluation of the site, and are provided in Appendix A. These results are also presented in Table 1, with general background soil values for the area from Shacklette and Boerngen (1984).

Applied Hydrology Associates (AHA, 1983) performed leach tests on samples of materials from the largest Unlined Evaporation Pond, the northern Lined Evaporation Pond, and the Sulfide Tailings Area. Leaching of the tailings material produced sulfate and calcium-dominated water, with arsenic and manganese concentrations above laboratory detection limits. Leachate from evaporation pond samples was elevated for a number of chemical constituents, notably sulfate, copper, iron, and manganese. A portion of the AHA report, including test results, is included in Appendix A.

As part of the engineering design of Arimetco's Phase IV-VLT Heap Leach Pad (Arimetco, 1993), a sample of proposed leach material from the VLT and a sample from the Sulfide Tailings ("Arimetco Clay") were tested under the Nevada Division of Environmental Protection's (NDEP's) Meteoric Water Mobility Procedure (MWMP). In addition, the VLT sample was subjected to static testing (i.e., acid/base accounting). The results of these tests are included in Appendix A. The acid-base accounting (ABA) results indicate that this material is slightly acid consuming (net acid neutralization potential, 0 > NNP < 10).

Recently, in the course of implementing the Final Work Plan for Interim Response Action – Temporary Cover of Two Iron Bleed Tailings Areas, NDEP (2002; Appendix A) collected six discrete soil samples from the VLT area and six discrete and one composite soil sample from the Iron Bleed areas. These samples were subjected to iterative leaching tests and laboratory analyses, using the Synthetic Precipitation Leaching Procedure (SPLP; SW846 MTD 1312) and EPA Method 200.7 (Inductively Coupled Plasma / Atomic Emission Spectometry), respectively. Table 2 presents a summary of the analytical results (also included in Appendix A), which indicate that the effluent pH was approximately the same as the lixiviant pH, suggesting that the sampled materials were not acid generating.

Material Geotechnical Properties

During engineering design of Arimetco's Phase IV-VLT Heap Leach Pad (Arimetco, 1993), samples of VLT and sulfide tailings were tested for particle size distribution (Arimetco, 1993). Oxide Tailings were found to be "poorly graded sand with silt and gravel (SP-SM)". Sulfide tailings were classified as a "Grey Lean Clay (CL)". Sulfide tailings were also evaluated for compaction characteristics, Atterberg Limits (plasticity and liquidity), and remolded permeability, using ex-situ methods. Sulfide tailings appear to be very uniform, with an estimated saturated permeability on the order of approximately 2 x 10^{-7} cm/second. This low permeability resulted in its use throughout the mine site as a secondary liner material.

Arimetco (1993) analyzed two VLT samples for copper content as a function of particle size. The analytical results are very similar to those from the Phase IV-VLT engineering design sample, demonstrating the homogeneous character of the Oxide Tailings. These results are also included in Appendix B.

Physical Stability

Engineering documents prepared for the Phase IV-VLT Heap Leach (Arimetco, 1993) included an evaluation of slope stability and soil strength properties. This report recommended constructed slope angles and benches, and included an evaluation of the liner strength of the Sulfide Tailings. The individual tailings material types appear to be consistent with regard to particle size distribution and geotechnical properties.

Pond Liners

In this Work Plan, "unlined" ponds refers to ponds for which various historical descriptions either explicitly state that the ponds are not lined, or where no reference to liners has been found. "Lined" ponds consist of evaporation ponds described as having an asphalt, compacted clay or high-density polyethylene (HDPE) liner.

1.4 Data Quality Objectives

The Data Quality Objectives (DQOs) for field sampling and analytical activities described in this Work Plan include the collection of appropriate data to support the:

- Assessment of current ecological and human health risk from exposed Tailings Area and Evaporation Pond materials to possible receptors; and
- Development and evaluation of closure alternatives for the Tailings Areas, Evaporation Ponds and associated mine units.

A four-step DQO process was utilized to develop the activities described in this Work Plan. The DQOs will ensure that data of sufficient quality and quantity are collected to meet the project objectives. The four steps include:

- Step 1. State the Problem;
- Step 2. Identify the Decision;
- Step 3. Identify the Inputs to the Decision; and
- Step 4. Define the Boundaries of the Study.

The problem statement (Step 1) is as follows: "Materials from Tailings Areas, Evaporation Ponds and spatially related mine units may have the potential to create a risk to human health and the environment, and to potentially degrade groundwater beneath the Yerington Mine Site".

Step 2 of the DQO process (Identify the Decision) asks the key question that this Work Plan is attempting to address: "What monitoring, sampling and analytical activities for the Tailings Areas, Evaporation Ponds and related mine units will serve to evaluate the potential for ecological and human health risk, potential degradation of groundwater, and support closure of the Yerington Mine site?" The field monitoring and sample collection and analysis activities proposed in this Work Plan will be integrated with previous and ongoing investigations and analytical results to answer this question. The criteria necessary to determine if the proposed Work Plan activities will answer this question include:

- Will the collected data adequately document the potential source characteristics and potential migration pathways of solids and liquids associated with the Tailings Areas, Evaporation Ponds and related mine units;
- Will the collected data provide sufficient information to develop and evaluate closure alternatives for the Tailings Areas, Evaporation Ponds and related mine unit materials.

Step 3 of the DQO process (Identify the Inputs to the Decision) identifies the kind of information that is needed to address the question posed under Step 2. This information consists of hydraulic and geochemical properties of tailings and evaporation pond materials, integrated with the information collected in two companion Work Plans (Groundwater Conditions and Fugitive Dust). The information obtained from the proposed site investigation activities will provide an adequate basis to address the other criteria of the DQO Process.

Step 4 of the DQO process (Define the Boundaries of the Study) defines the spatial and temporal aspects of the field monitoring, sampling and analytical activities proposed in this Work Plan. The field and analytical activities described in this Work Plan for tailings and evaporation pond materials will be conducted in 2003.

The DQO steps described above are consistent with the flow diagram presented in the Conceptual Site Model for the Yerington Mine, reproduced as Figure 3 of this Work Plan. The Tailings Areas, Evaporation Ponds and related mine units are identified as potential sources within the "surface mine units and process areas" category in Figure 3.

SECTION 2.0
BACKGROUND INFORMATION

This section describes the Tailings Areas, Evaporation Ponds and related mine units organized under the following headings:

- Construction and Operation
- Land Status
- Physical Description

Section 2.9 and Appendix C provide an historical review of the development of the tailings and pond areas. Appendix D presents recent photographs of some of these areas.

2.1 Oxide Tailings (VLT) Area

Construction and Operation

Oxide or vat leach tailings (VLT) are the leached products of Anaconda's Vat Leach copper extraction process. In this Work Plan, the materials are referred to as VLT and the area where they were deposited is referred to as the Oxide Tailings Area. The vat leach process involved serial crushing of oxide copper ore to a uniform, minus 0.5-inch size. The crushed ore was loaded into one of a row of eight large concrete leach vats where a weak sulfuric acid water was circulated through it over a period of about eight days. Pregnant leach water leaving the vats was conveyed to nearby copper precipitation vats, where cement copper was precipitated onto scrap iron and de-tinned cans. The barren water was then passed to iron launders where excess iron was removed, and the water was then reused in the Leach Vats (Dalton, 1998).

After the eight-day vat leach process, the spent ore was removed from the vats by a "clamshell" (a cable-operated excavator used in confined space operations) and loaded to a belt conveyor running along the row of vats. This conveyor delivered the spent ore or tailings to haul trucks for conveyance to the Oxide Tailings Area at a rate of about ten thousand tons per day, beginning in 1953 (Dalton, 1998). The sulfate- and iron-rich water that resulted from this process was delivered after treatment to remove acidity to the Unlined and Lined Evaporation Ponds northwest of the Sulfide Tailings Area (Dalton, 1998).

Land Status

The Oxide Tailings Area is located almost entirely on private land (Figure 2). A portion of the southwest corner is located on land controlled by the BLM. The historic Weed Heights Landfill, which was operated by Don Tibbals and others, is contiguous with, covered by, and may be built on VLT deposited early in the operational history of the site (Joe Sawyer, SRK; pers. comm., 2002). The areal extent of this landfill is accounted separately from the Oxide Tailings Area in this Work Plan.

Physical Description

The Oxide Tailings Area covers an area of approximately 500 acres, with an average height of over 100 feet. Its surface is composed of multiple benches and "end-dump" mounds of VLT (see Appendix D, Photo 1). It has a maximum elevation of approximately 4,622 feet above mean sea level (amsl) near its center, and a minimum elevation of approximately 4,440 feet amsl at its northern end. Slopes up to 80 feet high exist on the north, west, and southeast portions of the Oxide Tailings Area. These slopes area generally sloped, without benches, at or near the angle of repose (see Appendix D, Photo 2). Access to the surface of the tailings is via roads from the Phase IV-VLT Heap Leach Pad, and via entrance ramps on the north and south ends (Figure 4). Stormwater may either pond on the surface, or run off to an adjacent slope.

Based on visual observations, VLT materials consist of generally homogeneous quartz monzonite with a particle size range from approximately 0.5-inch to fine sand size. Because of its consistent material characteristics, similar to an aggregate base, VLT has been used in asphalt, concrete, for construction of embankments, and as engineered fill and capping materials (on and off the mine site by private parties and Lyon County). In planning for the Phase IV-VLT Heap Leach project, Arimetco (1993) estimated that 70 million tons remained in the Oxide Tailings Area. Field observations and review of topographic maps suggest that the slopes within the Oxide Tailings Area are stable.

2.2 Sulfide Tailings Area

Construction and Operation

Sulfide tailings resulted from the sulfide ore beneficiation process that operated between 1965 and 1978. The sulfide ore process circuit involved fine crushing and copper sulfide recovery by chemical flotation, in which lime was added to maintain a basic pH water. The tailings were deposited as slurry in designated pond areas, from which the decanted water was pumped back to the process circuit via water recycling ponds (Dalton, 1998). Seepage from the northernmost portion of the Sulfide Tailings Area was collected in a peripheral ditch and recycled along with the process water. The tailings ponds dried soon after milling ceased in June 1978, whereas the water in the Unlined Evaporation Ponds took longer to dry (Applied Hydrology Associates, 1983).

Land Status

The Sulfide Tailings are approximately evenly distributed between public land, managed by the BLM, and private land. A Class III Landfill operated by Arimetco, described in Section 2.6, is located on BLM land. The majority of clay borrow material used to construct Heap Leach Pad liners was excavated from the area of private land shown in Figure 2.

Physical Description

The sulfide tailings impoundment consists of an embankment built of VLT materials on the north and east (downslope) faces. The embankment (see Appendix D, Photo 3) rises from a base elevation of approximately 4,360 feet amsl on the east face to 4,400 feet amsl at its crest. The embankment slopes to the northeast, consistent with underlying topography. Volunteer vegetation has locally developed on the Sulfide Tailings Area (see Appendix D, Photo 4). As described above, sulfide tailings are classified as a uniform “grey lean clay” in previous geotechnical characterization for use as liner materials.

2.3 Process Water Recycling Ponds

Construction and Operation

A number of pond cells exist on the southern margin of the Sulfide Tailings Area (Figure 2). Dalton (1998) describes Anaconda's sulfide or processing circuit as including a water recovery process via clarification ponds, but does not specify pond locations or provide additional descriptions. Homogeneous fine-grained materials found in the Sulfide Tailings may be expected to require a long holding period and multiple ponds for clarification. Given the large number and geometry of the ponds south of the Sulfide Tailings Area, this area likely served as the process water clarification area.

Land Status

The Process Water Recycling Ponds are located on both public land controlled by the BLM and private land.

Physical Description

The materials in these ponds (see Appendix D, Photo 5) appear to consist of homogeneous reddish to grayish clay-size particles. Some of the ponds have been covered with VLT material. With little exception, the pond materials appear to be identical to sulfide tailings in color and grain size.

2.4 Unlined Evaporation Ponds

Construction and Operation

A total of six Unlined Evaporation Ponds are located within the Yerington Mine Site, and are shown in Figures 2 and 6. The largest is a triangular facility designated as the Unlined Evaporation Pond, which is located at the northwest corner of the Sulfide Tailings Area. This pond was used to manage water from the oxide and sulfide processing circuits (Dalton, 1998). Water from the oxide process was delivered to the ponds at an estimated rate of up to 700 gpm.

The remaining five unlined ponds are called Finger Evaporation Ponds, which were constructed and partially filled in prior to Arimetco's start of operations in 1989 (Arimetco constructed the first portions of the Phase IV-VLT Heap over the southern half of these ponds; Arimetco, 1993). Three of the Finger Ponds (segments A, B, and D shown in Figure 6) have been filled in, apparently with native alluvial material. The area of the Finger Ponds included approximately 13 acres of exposed red tailings, the southeast corner of which Arimetco excavated during heap construction (Joe Sawyer; pers. comm., 2002). The entire area was capped with VLT by the NDEP to control dust in 2000 and 2001.

Land Status

The largest Unlined Evaporation Pond is approximately evenly distributed between public land controlled by the BLM and private land. The Finger Evaporation Ponds are located entirely within private land.

Physical Description

Each of the Unlined Evaporation Ponds (See Appendix D, Photo 6) consists of a shallow, or no, excavation at its south end, and a berm of alluvium or mixed alluvium and VLT materials at its north, downslope end. The basal portions of the largest Unlined Pond and Finger Ponds C and E are exposed.

2.5 Lined Evaporation Ponds

Construction and Operation

The North, Middle, and South Lined Evaporation Ponds were placed into operation between 1960 and 1978. Their use was similar to that of the Unlined Evaporation Ponds described above. Subsequently, a portion of this area was used to construct three lined Pumpback Evaporation Ponds to manage groundwater pumped along the northern margin of the mine site.

Land Status

The Lined Evaporation Ponds are located almost entirely within land controlled by the BLM. A portion along the western margin of the North, Middle, and South Lined Evaporation Ponds is located within private land.

Physical Description

Each of the North, Middle, and South Lined Evaporation Ponds (See Appendix D, Photo 7) consists of a shallow, or no, excavation at its south end, and a berm of alluvium at its north, downslope end. The ponds are reported to be asphalt and possibly clay-lined (Joe Sawyer; pers. comm., 2002). Materials in these ponds appear similar to those observed in the largest Unlined Evaporation Pond.

The Pumpback Evaporation Ponds (See Appendix D, Photo 7) contain a managed quantity of groundwater during most of the year. The ponds were lined with compacted clay material (permeability on the order of 10^{-5} to 10^{-7} cm/s). Liners were improved with single 60-mil HDPE liners added to the middle and south cells, between 1999 and 2001 (AHA, 2002).

2.6 Weed Heights Sewage Lagoon

Construction and Operation

As shown in Figures 2 and 4, a sewage treatment system was constructed in 1985 to serve the Weed Heights community, and consists of:

- Two septic tanks near the Process Areas;
- Sewage effluent pipelines from Weed Heights and the Arimetco Electro-winning Plant to the septic tanks; and
- Sewage effluent pipelines from the tanks to sewage lagoons in the northern portion of the mine site.

The lagoons were originally located within the Finger Evaporation Ponds, but were relocated to the southwest corner of the South Lined Evaporation Pond during construction of the Phase IV-VLT Heap Leach Pad (Joe Sawyer; pers. comm., 2002).

Land Status

The majority of the sewage system is located on private land, and a portion of the Sewage Lagoons is located on BLM land (Figures 2 and 6).

Physical Description

The Sewage Lagoons appear to be lined facilities (although information regarding the liner type could not be found) with containment berms constructed of alluvial materials.

2.7 Arimetco Landfills and Abandoned Mine Units

Construction and Operation

Arimetco mine units located outside of the Arimetco Plant Site Area (the subject of a companion Work Plan), include a Class III Landfill within the Sulfide Tailings Area and a bin support structure located at the north end of the Oxide Tailings Area. Other miscellaneous pipelines and materials not included in other Work Plans are incorporated into this Work Plan.

Land Status

Abandoned Arimetco features lie within both private and public lands. The Arimetco Class III Landfill is located within land controlled by the BLM.

Physical Description

The landfill, shown in Figure 5, is partially buried with VLT.

2.8 Transite Pipe

Construction and Operation

A bell-and-spigot transite pipeline constructed of concrete and that was used to convey process water and sulfide tailings slurry exists at various locations at the mine site. It was noted during preliminary reconnaissance on the ground surface along the eastern and northern edges of the W-3 Waste Rock Dump south of the Weed Heights access road to the Arimetco Plant Site, and from the Plant Site north to the Sulfide Tailings.

Land Status

The pipeline traverses both private and public lands. Its alignment will be mapped as part of this Work Plan.

Physical Description

The pipeline consists of 12-inch bell-and-spigot 15-foot long segments. It is anchored by rebar and rope, cable, and other ties at many of the bell-and-spigot connections, and portions of the pipe have been repaired by rubber and steel pressure couplings.

2.9 Historic Tailings Area and Evaporation Pond Development

The temporal and spatial distribution of the Tailings Areas, Evaporation Ponds and related mine units discussed in Sections 2.1 through 2.7 are identified in the photos and maps provided in Appendix C, and are briefly described below:

1954 Aerial Photo (C1)

North of Weed Heights and the Anaconda Plant Site, developing portions of the Oxide and Sulfide Tailings Areas and largest Unlined Evaporation Pond can be seen in this photo. Oxide Tailings were deposited in linear piles generally parallel to topography and covered approximately 115 acres in 1954. Process water appears to have been placed over the natural ground surface to where it was contained by a berm/road feature (corresponding to the northern margin area of the current Unlined Evaporation Pond). The area of deposited process water covers approximately 260 acres in this photo.

1957 USGS Wabuska, NV Topographic Map (C2)

The Oxide Tailings Area is generally similar in size to the area shown in the 1954 photo. A large "Tailings Pond" covers the majority of the tailings depositional area shown in the 1954 photo with distinctive western, southern and eastern boundaries (shown as roads on this map). This map depicts process water being managed in a more laterally contained area than in 1954.

1977 Aerial Photo (C3)

The 1977 aerial photo mosaic provides a color illustration of the mine prior to close of operations. All features discussed in this Work Plan are clearly shown. The Finger Evaporation Ponds and the Process Water Recycling Ponds extend north and northeast of the Oxide Tailings, respectively. The Unlined Evaporation Pond in this photo covers a portion of the tailings depositional area seen in the 1954 photo, and is located northeast of the largest Finger Evaporation Pond. The Sulfide Tailings Area is located northeast of the Process Water Recycling Ponds. The Lined Evaporation Ponds are located north of the Unlined Evaporation Pond, and north of the original berm that contained Sulfide Tailings in 1954.

Water containment ditches can be seen in this photo, and are located immediately north of the Unlined Evaporation Pond and along the northern portion of the Sulfide Tailings Area. Approximate areas of these features are: Oxide Tailings Area – 350 acres (a portion of which is now covered by the Arimetco Phase IV-VLT Heap Leach Pad); Finger Ponds – 125 acres (a portion of which is now covered by the Arimetco Phase IV Heap Leach Pad); Recycling Ponds – 287 acres; Unlined Evaporation Pond – 116 acres; Lined Evaporation Ponds – 92 acres; and Sulfide Tailings Area – 385 acres.

1980 Infrared Aerial Photo (C4)

This photo mosaic shows drying tailings and ponds areas with localized occurrences of standing water in the Unlined Evaporation Pond and in the North, Middle, and South Lined Evaporation Ponds. Depositional paths of Sulfide Tailings and evidence of erosion of a small portion of the northeast margin of the Oxide Tailings can also be seen.

1987 USGS Mason Butte, NV Topographic Map (C5)

This map indicates similar features to those visible in the 1977 and 1980 aerial photos. The large Finger Pond "E" is mapped as "Tailings" and is shown in two sections (this partition is not distinguishable today). The southern portion of the Wabuska Drain is also seen on this map.

2001 Color Air Photo (C6)

The effects of Arimetco's operations in this portion of the mine site are visible: removal of a portion of the VLT and construction of the Phase IV-VLT Heap Leach Pad and associated ponds. The Weed Heights Sewage Lagoons are also shown. The Pumpback Evaporation Ponds are located north of the Unlined Evaporation Pond and east of the Lined Evaporation Ponds. Current areas developed from an orthographically corrected version of this aerial photograph series are: Oxide Tailings Area – 344 acres; Finger Ponds – 46 acres; Recycling Ponds – 287 acres; Unlined Evaporation Pond – 116 acres; Lined Evaporation Ponds – 92 acres; Pumpback Evaporation Ponds – 24 acres; and Sulfide Tailings Area – 385 acres.

2.10 Summary of Current Conditions

After filing for bankruptcy in 1997, Arimetco abandoned its operations at the Yerington Mine in January 2000. Current site care and maintenance involves heap water management, operation of the pumpback well and evaporation system, general site clean-up and site security.

Pursuant to an NDEP Administrative Order, Atlantic Richfield currently operates three Lined Pumpback Evaporation Ponds near the northern end of the property to manage groundwater produced by the pumpback well system. The Weed Heights Sewage Lagoons and septic system are currently functional, and serve the Weed Heights community. The Weed Heights landfill may still be operated intermittently. NDEP currently manages heap fluids from the Arimetco heap leach pads using a combination of active and passive evaporation. The Arimetco landfill is still in use by on-site contractors.

SECTION 3.0
WORK PLAN

Atlantic Richfield proposes to conduct site investigations of the tailings areas, evaporation ponds and associated mine units in a manner consistent with the DQOs described in Section 1.4. Based on the information presented in Sections 1.3 and 2.0, the origin, spatial distribution and geochemical characteristics of solid materials in the Oxide and Sulfide Tailings Areas, and the sediments in the Evaporation Ponds are generally known. Past operations that included solids or slurry materials deposition, and associated water management, appear to have been fairly consistent. The degree of homogeneity observed and measured for oxide and sulfide tailings materials, and pond sediments, is characteristic of such process related materials. This Work Plan provides for the evaluation of the following general characteristics of each mine surface feature, and its associated components, as appropriate:

- Mine Unit Inventory and Description
- Material Volume
- Material Geochemical Analyses
- Material Geotechnical Analyses

Prior to the start of work, field personnel will conduct a health and safety meeting to review the Site Health and Safety Plan and to verify personal training certification. Copies of training certificates and attendance logs from the meeting will be obtained. All work will be conducted in accordance with the Site Health and Safety Plan, and with the JSA provided in Section 3.4.

3.1 Mine Unit Investigations

Field Reconnaissance and Catalogue

As stated previously, the physical and chemical characteristics of the Oxide and Sulfide Tailings Areas and Evaporation Ponds are reasonably well documented and understood. However, the associated mine units that exist outside of the Arimetco Plant Site and Mill Process Areas, subjects of companion Work Plans, are not completely delineated. Additional information for the Weed Heights Sewage Lagoon, Arimetco Landfills and Abandoned Features, and the Transite Pipe will be enhanced using the following steps:

- Field notes will be taken directly on an appropriately scaled base map and/or aerial photograph.
- Where appropriate, paced distance and/or hand-tape measurements of specific features will be recorded in a bound field notebook.
- Partial or complete exposure of landfill waste will be photographed and noted on the map. In the area of the Weed Heights Landfill, evidence of recent earthwork (bulldozer tracks, sunken fills, etc.) will be used to delineate the boundaries of solid waste. Telephone or in-person interviews and field evidence will be used to understand the present status of the Landfill.
- The entire length of the Transite Pipe will be mapped using a hand-held GPS unit. Features such as culverts, road crossings, breaks and extra pipe sections will be noted on the base map and, if appropriate, documented by photographs. Field screening for pH will be conducted underneath the pipeline where breaches in the pipe or stained soil is observed, and if warranted, samples will be collected below the pipeline. Field screening and sample collection would be conducted in accordance with methods and criteria detailed in the Draft Quality Assurance Project Plan (QAPP) for the Yerington Mine Site.
- Tailings areas, evaporation ponds and the Weed Heights Sewage Lagoons will be more closely inspected and photographed, with particular attention being given to pipe inlets or outlets, and liner or berm conditions.

Material Volumes

The quantity of material contained in the Oxide and Sulfide Tailings Areas will be calculated by interpolating adjacent grades to estimate original ground topography, and comparing this surface with a Digital Terrain Model (DTM) based on topography generated by August 2001 photogrammetric methods. Material volumes in each of the Evaporation Ponds will be estimated based on sediment thickness and type observed in one or more test pits, and the base aerial extent of the facility.

Material Geochemical and Geotechnical Characteristics

Given the homogeneity observed for the solid materials contained within the Tailings Areas and

Evaporation Ponds, the proposed sampling locations shown in Figures 4, 5, and 6 should be sufficient for a complete geochemical and geotechnical characterization of these mine units. Where vertical or lateral heterogeneity of tailings materials may occur, or where materials are covered with alluvium or VLT, excavated samples will be obtained from the tops or side slopes of these areas. A summary of proposed samples is presented below:

Oxide Tailings Area (Figure 4)

- At four locations, samples will be collected and composited from 0 to 12 inches below the surface from 3 sub-samples at each sample location (see below).
- Each composited sample will be analyzed for acid-base-accounting (ABA), whole-rock analysis, agricultural parameters and grain size (see below).
- A soil-moisture monitoring station will be installed, as described in the Draft Groundwater Conditions Work Plan. A borehole will be drilled through the subsurface to an approximate depth of 100 to 200 feet below the surface of the Oxide Tailings Area, depending on site access and safety concerns. A vertical series of moisture probes will be installed at selected depths to monitor the potential flux of meteoric water through the VLT. VLT samples will be collected from lithologically diverse materials for geotechnical analyses to assist in probe calibration and mine unit characterization.

Sulfide Tailings Area (Figure 5)

- At two locations, samples will be collected and composited from 0 to 12 inches below the surface from 3 sub-samples at each sample location (see below).
- Each composited sample will be analyzed for acid-base-accounting (ABA), whole-rock analysis, agricultural parameters and grain size (see below).
- Two monitor wells will be installed to a depth of approximately 10 feet below the static groundwater surface in the underlying alluvial aquifer, as described in the Draft Groundwater Conditions Work Plan. Samples from lithologically diverse materials will be collected for geotechnical analyses to assist in mine unit characterization.
- A soil-moisture monitoring station will be installed, as described in the Draft Groundwater Conditions Work Plan. A borehole will be drilled through the subsurface to an approximate depth of 80 to 100 feet below the surface of the Sulfide Tailings Area, depending on site access and safety concerns. A vertical series of moisture probes will be installed at selected depths to monitor the potential flux of meteoric water through the sulfide tailings. Sulfide tailings samples will be collected at 20-foot intervals for geotechnical analyses to assist in probe calibration and mine unit characterization.

Recycling Ponds (Figure 5)

- At four locations, samples will be collected and composited from 0 to 12 inches below the surface from 3 sub-samples at each sample location (see below).
- Each composited sample will be analyzed for acid-base-accounting (ABA), whole-rock analysis, and grain size (see below).

Finger Evaporation Ponds (Figure 6)

- At three locations, samples will be collected and composited from 0 to 12 inches below the surface from 3 sub-samples at each sample location (see below).
- Each composited sample will be analyzed for acid-base-accounting (ABA), whole-rock analysis, and grain size (see below).

Unlined Evaporation Ponds (Figure 6)

- At four locations, samples will be collected and composited from 0 to 12 inches below the surface from 3 sub-samples at each sample location (see below).
- Each composited sample will be analyzed for acid-base-accounting (ABA), whole-rock analysis, and grain size (see below).

Lined Evaporation Pond (Figure 6)

- At three locations, samples (one each from the South, Middle and North Ponds) will be collected and composited from 0 to 12 inches below the surface from 3 sub-samples at each sample location (see below).
- Each composited sample will be analyzed for acid-base-accounting (ABA), whole-rock analysis, and grain size (see below).

3.2 Data Collection and Analysis Procedures

Procedures for data collection and analysis will follow the specifications and standard operating procedures (SOPs) described in this section. These SOPs have been developed in accordance with the Draft Quality Assurance Project Plan (QAPP) for the Yerington Mine Site to ensure that the quality and quantity of the analytical data obtained during the field activities are sufficient to support the DQOs. Quality assurance and quality control (QA/QC) issues for this work plan include:

- Detection limit and laboratory analytical level requirements;
- Appropriate field quality control protocols (e.g., sample collection, labeling and transport, instrument calibration);
- Appropriate field quality assurance protocols (e.g., blanks and duplicate samples); and
- Selection of appropriate levels of precision, accuracy, representiveness, completeness, and comparability for the data and any specific sample handling issues.

Solids Sampling

At each sample location, a visual description (accompanied by a photograph) and field notebook record will be made of the sample excavation for pond and tailings materials including cover type, if any. Solid materials will be sampled by excavating, with hand tools (e.g., disposable plastic trowels or shovels) a continuous interval of materials to allow for the collection of different solid media (e.g., grain size, color, etc.) that may be present in some or all of the proposed sample locations. As required, backhoe excavations or auger drilling will be employed to reach depths greater than hand excavation will allow. Samples collected from boreholes drilled for monitor wells or soil moisture monitoring boreholes will be subject to SOPs described in the Draft Groundwater Conditions Work Plan.

The sampled materials will then be shaken in a 5-gallon bucket to eliminate strata variation effects, and the following splits will be obtained by hand-sorting to eliminate oversized material:

- For whole-rock analysis, obtain a 2 kg (approximately 1 quart) sample in a clean re-sealable baggy.
- For agricultural and ABA analyses, obtain a minimum of two 1 kg (approximately 1 pint) samples in clean re-sealable baggies.
- For geotechnical analyses, obtain an 18 kg sample in a clean bucket.

After obtaining these samples for geochemical analyses, the 5-gallon bucket will be filled in the same manner with material from the same location, including surface material, for geotechnical analysis. For VLT and sulfide tailings materials, a composite sample of approximately equal parts from each of two sample locations will be made. For the Unlined Evaporation Pond, a composite of "yellow" or "red" tailings materials will be made by thoroughly mixing material from each of the proposed sample locations. For the Finger Evaporation and Unlined Evaporation Pond locations, a composite sample from single samples in each pond of each distinguishable material (if more than one is identified) will be made. Each sample will be sealed and labeled with QA/QC procedures described below prior to shipment to the analytical laboratory.

Materials Analysis

Samples specified for whole-rock analysis will be analyzed by a Nevada-certified laboratory for the geochemistry of the digested rock and soil material. The constituents to be analyzed and analysis methods are listed in Table 3. Detection limits will be equal to or lower than those indicated in Table 3. Samples for the analysis of agricultural properties will be analyzed for Nitrogen, Phosphorus and Potassium (NPK) concentrations; Boron, Chlorine, Calcium, Magnesium and Sodium concentrations; and the calculation of the Sodium Absorption Ratio (SAR). The agricultural parameter data will support the characterization of the sampled solid materials for use as growth media.

The potential for materials, particularly sulfide tailings and pond sediments, to generate fugitive dust, and the capacity of all materials to retain moisture will be evaluated. Samples will be collected for laboratory analysis of grain size distribution (ASTM D-422) and moisture retention capacity (ASTM D-2325 and D-3152). The grain size distribution data will be used to estimate hydraulic characteristics of the materials. This information will provide the basis to evaluate the potential for these surface mine units to allow meteoric water to percolate and, potentially, leach constituents of concern to underlying groundwater under current and "closed" conditions. The data will also support surface hydrologic (i.e., run-off) analyses.

Sample Identification

Sample labels will be completed and attached to each laboratory sample container after each sample is collected. Strict attention will be given to ensure that each sample label corresponds to the collection sequence number marked on the bottle prior to sample collection. The labels will be filled out with a permanent marker and will include the following information:

- Sample identification
- Sample date
- Sample time
- Analyses to be performed
- Person who collected sample

Each sample will be tracked according to a unique sample field identification number assigned when the sample will be collected. This field identification number will consist of:

- Sampling location
- Collection sequence number and date

For example, the sample collected from the Sulfide Tailings Area at the second location sampled will be labeled: 002STA061903.

<u>Sample Handling and Transport</u>

Each geochemical sample container will be labeled, sealed with a custody seal, sealed in a zip-loc© bag, logged on a chain-of-custody form, and placed in an insulated ice chest with ice. Contained ice will be double bagged in zip-loc plastic bags. Samples will be wrapped in sufficient protective material (e.g., plastic bubble-wrap) to prevent breakage during transport. The ice chest will be sealed shut with strapping tape and two custody seals will be placed on the top of the ice chest. If the ice chest is being sent by mail: a) enclose the chain of custody form and other sample paperwork in the ice chest by placing it in a plastic bag and taping the bag to the inside of the ice chest lid; and b) label the ice chest with “Fragile” and “This End Up” labels. Transport ice chests to the appropriate laboratory by hand-delivery as soon as possible or via express overnight delivery. Coordinate deliveries with the laboratory, ensuring that holding times are not violated. Geotechnical samples will be collected in the bucket used for sampling, sealed, and delivered to the laboratory with the appropriate chain-of-custody information.

Each chain-of-custody will contain the following information:

- Project name
- Sampler's name and signature
- Sample identification
- Date and time of sample collection
- Sample matrix
- Number and volume of sample containers
- Analyses requested
- Method of shipment

For soil or sediment samples collected for ABA or whole-rock analysis, each sample will be collected in zip-loc bags or a five-gallon bucket that will be sealed and labeled with similar QA/QC procedures described for other soil sample labeling and packaging prior to shipment to the analytical laboratory.

Duplicate Samples and Blanks

The QA objectives for collection of field samples are to verify that collection, packaging, and shipping are not introducing variables into the sampling chain that could provide any basis to question the validity of the analytical results. In order to fulfill these QA objectives, duplicate and blank QA samples will be used as described below. If the analysis of any QA samples indicates that variables are being introduced into the sampling chain, then the samples shipped with the questionable QA sample will be evaluated for the possibility of contamination.

Duplicate samples will be collected at a frequency of one per every 10 samples for each analysis. Duplicate samples will be collected by filling the containers for each analysis at the same time the original sample is collected. In general, duplicate samples will be collected in the same manner as regular samples. For quality assurance purposes, duplicate samples will be labeled in the same fashion as regular samples, with no indication that they are QC samples. Each sample from a duplicate set will have a unique sample number labeled in accordance with the identification protocol (refer to QAPP), and the duplicates will be sent "blind" to the lab. For example, the duplicate sample to "002STA061903" might be labeled "003STA061903".

In general, equipment rinsate blanks will be collected when reusable and non-disposable sampling equipment (e.g., water level probe) will be used. Equipment rinsate blanks will be collected to evaluate field sampling and decontamination procedures by pouring laboratory-grade, certified organic-free water over the decontaminated sampling equipment. A minimum of one equipment rinsate blank for each matrix (e.g., soil, groundwater, etc.) is prepared each day when equipment is decontaminated in the field.

The rinsate blanks that are collected will be analyzed for the same analytes as normal samples. The equipment rinsate blanks will be preserved, packaged, and sealed in the manner described in the QAPP. A separate identification sample number will be assigned to each rinsate blank, and it will be submitted blind to the laboratory.

Field blanks will be collected to evaluate whether contaminants have been introduced into the samples during the sampling procedures. For groundwater or surface water samples, field blanks will be created by pouring laboratory-grade de-ionized or certified organic-free water into a sampling container at one of the sampling points. Field blanks will be collected at a frequency of one per every 20 samples, with a minimum of one blank for less than 20 samples.

The exact same collection procedures will be used for preparation of field blanks as was used for regular sampling. The field blanks that are prepared will be analyzed for the same analytes as regular samples. The field blanks will be preserved, packaged, and sealed in the manner described in the appropriate section for the type of medium being prepared. A separate identification sample number will be assigned to each blank, and it will be submitted blind to the laboratory.

Trip blanks will be prepared to evaluate if the shipping and handling procedures are introducing contaminants into the sample stream and if cross contamination in the form of migration has occurred among the collected samples. For groundwater or surface water samples, field blanks will be created by pouring laboratory-grade de-ionized or certified organic-free water into a sampling container at one of the sampling points. The sealed trip blanks are not opened in the field and are shipped to the laboratory in the same insulated chest with the regular samples collected for analyses. The trip blanks will be preserved, packaged, and sealed in the manner described in the QAPP for the type of medium being prepared. A separate identification sample number will be assigned to each trip blank and it will be submitted blind to the laboratory. Trip blanks will be collected at a frequency of one per sampling event per type of matrix, whether that event occurs over one day or several days.

Decontamination

All soil collection (sampling) equipment will be decontaminated between each excavation. Disposable scoops or plastic trowels will be used, or sampling equipment will be decontaminated between each sampling location. Sampling equipment will be hand-washed with a solution of tap water and Alconox detergent, then double-rinsed. The decontamination wash would be accomplished with clean buckets, filled half to three-quarters full as follows:

- Bucket 1: Tap water with non-phosphate detergent such as Alconox.
- Bucket 2: Clean tap water or de-ionized water.
- Bucket 3: Clean tap water or de-ionized water.

Equipment decontamination will consist of the following general steps:

- Removal of gross (visible) contamination by brushing or scraping.
- Removal of residual contamination by scrub-washing in Bucket #1, rinsing in Bucket #2, then rinsing in Bucket #3. Change the water periodically to minimize the amount of residue carried over into the third rinse.

All washing and rinsing water is considered investigation derived waste and will be placed in containers.

After use, gloves and other disposable PPE should also be containerized and handled as investigation derived waste.

Field Documentation

A summary of field measurements, sampling activities, and field observations will be recorded in a bound site logbook. Entries must contain accurate and inclusive documentation of project activities. Entries will be made using permanent waterproof ink, and erasures are not permitted. Errors will be single-lined out, should not be obscured, and initialed and dated. The person making the entries will sign at the beginning and the end of the day's entries, and a new page will be started for each day. The following entries will be made to the bound site logbook and/or filed log sheets:

- General descriptions of weather conditions
- Location of each sampling point
- Data and time of sample collection (field log sheets.)
- The type of blank collected and the method of collection
- Field measurements made, including the date and time of measurements
- Calibration of field instruments
- Reference to photographs taken
- Date and time of equipment decontamination
- Field observations and descriptions of problems encountered

Photographs will be taken at each field measurement/sampling point. The photo location and number will be recorded on the field log sheets. In addition to the logbook, an inventory of observed or reported chemicals would be conducted during the site investigation. The inventory would record the type of substance (phase and name, or unknown), type of container, and estimated quantity.

3.3 Site Job Safety Analysis

A site-specific Job Safety Analysis (JSA) for this Work Plan is attached as Appendix E, in accordance with Atlantic Richfield Health and Safety protocol and the Brown and Caldwell Yerington Mine Site

Health and Safety Plan (SHSP). The SHSP identifies, evaluates, and prescribes control measures for safety and health hazards, in addition to providing for emergency response at the Yerington Mine site. SHSP implementation and compliance will be the responsibility of Brown and Caldwell, with Atlantic Richfield taking an oversight and compliance assurance role. Any changes or updates will be the responsibility of Brian Bass with Brown and Caldwell, with review by Atlantic Richfield Safety Representative Lorri Birkenbuel. Three copies of this plan will be maintained. One copy will be located at the site, one copy will be located in Atlantic Richfield's Anaconda office, and one copy will be located in the Brown and Caldwell office.

The SHSP includes:

- Safety and health risk or hazard analysis;
- Employee training records;
- Personal protective equipment (PPE);
- Medical surveillance;
- Site control measures (including dust control);
- Decontamination procedures;
- Emergency response; and
- Spill containment program.

The SHSP includes a section for site characterization and analysis that will identify specific site hazards and aid in determining appropriate control procedures. Required information for site characterization and analysis includes:

- Description of the response activity or job tasks to be performed;
- Duration of the planned employee activity;
- Site accessibility by air and roads;
- Site-specific safety and health hazards;
- Hazardous substance dispersion pathways; and

- Emergency response capabilities.

All contractors will receive applicable training, as outlined in 29CFR 1910.120(e) and as stated in the SHSP. Copies of Training Certificates for all site personnel will be attached to the SHSP. Personnel will initially review the JSA forms at a pre-entry briefing. Site-specific training will be covered at the briefing, with an initial site tour and review of site conditions and hazards. Records of pre-entry briefings will be attached to the SHSP.

Elements to be covered in site-specific briefing include: persons responsible for site-safety, site-specific safety and health hazards, use of PPE, work practices, engineering controls, major tasks, decontamination procedures and emergency response. Other required training, depending on the particular activity or level or involvement, may include MSHA 40-hour training and annual 8-hour refresher courses. Other training may include, but is not limited to, competent personnel training for excavations and confined space, first aid, and cardio-pulmonary resuscitation (CPR). Copies of the 40-hour and annual refresher certificates, for site personnel, will be attached to the SHSP.

The individual JSA for the Tailings and Evaporation Ponds work incorporates individual tasks, the potential hazards or concerns associated with each task, and the proper clothing, equipment, and work approach for each task. The following table outlines the tasks and associated potential hazards that are included in the Tailings and Evaporation Ponds JSA:

SEQUENCE OF BASIC JOB STEPS	POTENTIAL HAZARDS
1. Collect solid materials samples	• Skin irritation from dermal or eye contact • Steep slopes, hard, sharp, irregular surfaces on all WRD's
2. All Activities	• Slips, Trips, and Falls
3. All Activities	• Back, hand, or foot injuries during manual handling of materials.
4. All Activities	• Heat exhaustion or stroke.
5. All Activities	• Hypothermia or frostbite
6. Unsafe conditions.	• All potential hazards.

A copy of the Tailings Impoundment JSA is provided in Appendix E.

SECTION 4.0

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